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# **Astronaut's Perspective**

## **Risk Management**

**J. D. Wetherbee**

# Risk Management

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- **Risk Evaluation Question:**
  - “Do the **Benefits** outweigh the **Risks**?”
  - **Benefit**
    - Gain
  - **Risk**
    - Probability of Loss

# Risk Management

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- **Risk Evaluation Question:**
  - “Do the **Benefits** outweigh the **Risks**?”
  - **Gains:**
    - Success, Advancement, Money, Fame, Prestige, Power, Exhilaration, Adventure, Excitement, (Competition)
  - **Losses:**
    - Failure, Schedule Delay, Money, Embarrassment, Demotion, Hardware Damage, Injury, Death

# Risk Management

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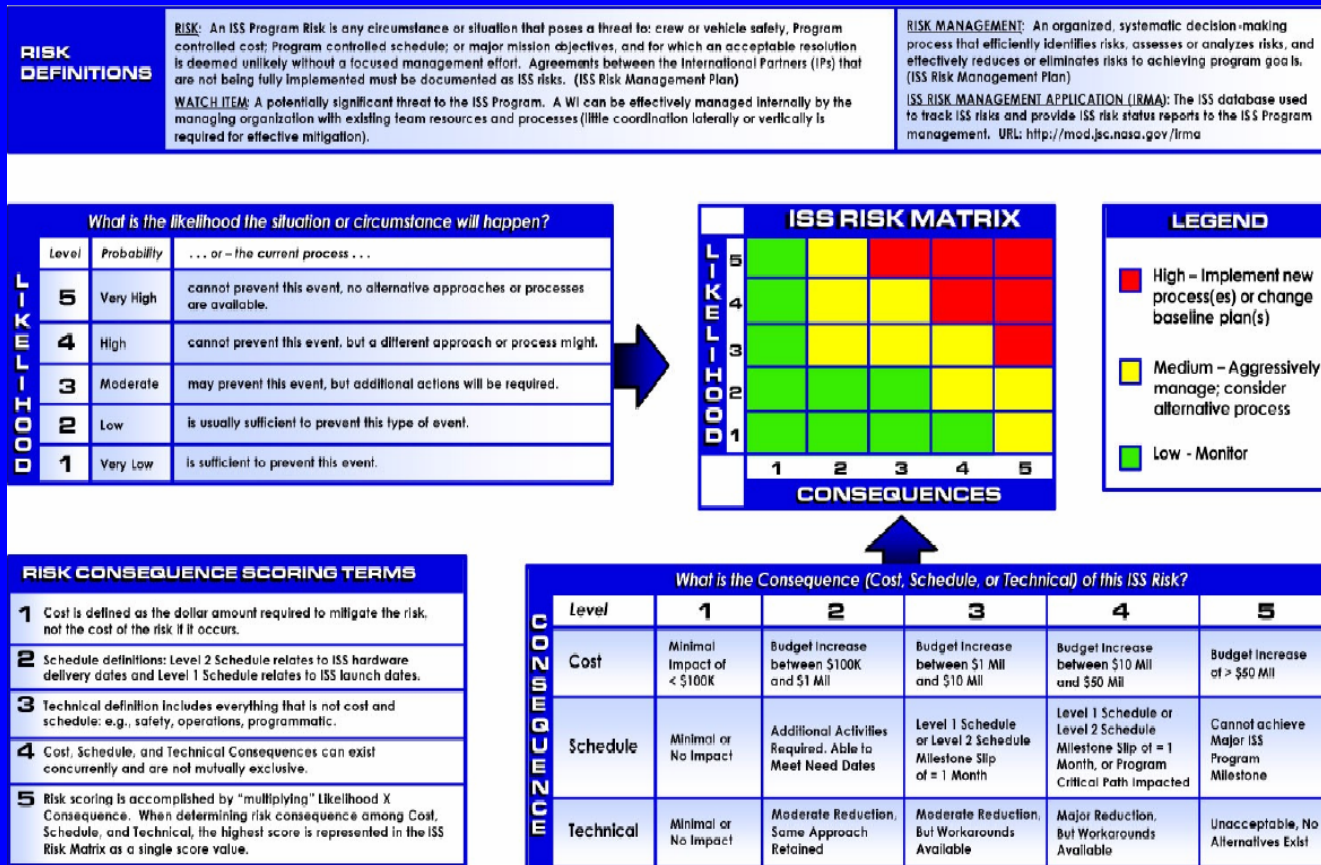
- **Types of Risk in Programs**
  - **1. Business Risk**
    - **Cost** or **Schedule** Challenges
    - (Usually not personal injury)
  - **2. Technical Risk**
    - Probabilities of **Mission Success**
      - Task and Procedure Complexity
    - (Can involve injury or loss of life)

# Risk Management

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- **1. Business Risk (Cost / Sched)**
  - **Standard Business Practices**
    - **Past Performance**
      - Metrics, Earned Value, Schedules, Progress Reports
    - **Present Performance**
      - Procedures, Cost Performance Index, Efficiencies, Optimization, Toyota Production System
    - **Future Predictions**
      - Estimated cost At Completion, Red/Green Stoplights, Management Reserves

# ISS Risk Matrix



# Risk Management

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- **2. Technical Risk**
  - **Policies**
    - Standards, Requirements
  - **Safety**
    - Hazard Analysis, Controls, PRA
  - **Reliability**
    - FMEA, CIL
  - **Quality**
    - Design, Test, Inspect, Surveil, Audit

# Risk Management

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- **2. Technical Risk**
  - **Boards, Processes**
    - Design Reviews [PDR, CDR]
    - Problem Resolution Teams (PRT)
    - Control Boards [MICB, SICB, PRCB]
    - Operational Reviews [PAR, FRR, L-2, MMT]



# Risk Management

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- **2. Technical Risk**

- **Maintenance**

- Operations and Maintenance Requirements and Specifications Document (OMRSD)
    - Operations and Maintenance Instruction (OMI)
    - Change Request (CR)
    - Requir. Change Notice (RCN)

# Risk Management

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- **2. Technical Risk**
  - **Operations**
    - Launch Commit Criteria
    - Flight Rules
    - Crew Procedures
    - Problem Tracking
      - PRACA, CAR, PR, MR, IFA

# Risk Management

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- **Technical Risk Mitigation**
  - **Organizational Control (Corporate)**
    - Policies
    - Training, Tools, Resources
  - **Personal Control (Individual / Team)**
    - Procedures
    - Situational Awareness, Judgment, Values, Ethics

# Deficiencies

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- **Executives and Managers**
  - Push decisions down, encourage risk acceptance at lower levels
    - Tough decisions not made at top, **deniability**
    - **Shift** responsibility and **accountability**
  - **Don't want Bad News**

# Deficiencies

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- **Supervisors and Workforce**
  - Eager to please bosses
    - Ironically, fall into culturally acceptable trap
      - **Compliance** and
      - **Willing Acceptance** of Responsibility and Accountability
    - **“Sunshine Reports”**
      - Optimistic Status Reports
      - Optimistic Problem Resolution plans

# Deficiencies

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- **Technical Risk – Personal Control**
  - Discussions regarding future death rarely occur
    - 1. Socially Unwelcome (Team)
      - Unproductive
      - Unwritten Rule, Superstition, Community Taboo
    - 2. Thoughts Not Entertained (Individual)
      - Faithful Trust
      - Comfortable Ignorance
      - Sense of Invulnerability

# Comparative Risk

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	<b>U. S. Air Carriers</b>	<b>Military Combat Jet</b>	<b>Space Shuttle</b>
<b>Cost per Vehicle</b>	<b>\$42 M (G-V) \$75 M (737)</b>	<b>\$49 M (F18)</b>	<b>\$2,000 M</b>
<b>Pilot Flight Time</b>			
<b>Risk of Loss</b>			

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Pilot Flight Time	65 – 80 Hrs./Mo.	28 Hrs./Mo.	15 Hrs./Mo.
Risk of Loss	1 / 3,700,00 ('94-'03)	1 / 20,000 (Since WWII)	1 / 57

# Favorable Characteristics

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- Comparison between Operators and Managers:

## **Operators**

**High Confidence**

**Healthy Self-Doubt**

## **Managers**

**High Confidence**

**Healthy Self-Doubt**

# Favorable Characteristics

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**(Hand-Eye Coordinin.?)**

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**(Elevated Intelligence?)**

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**(Hand-Eye Coordinin.?)**

**Mental Discipline**

## **Managers**

**High Confidence**

**Healthy Self-Doubt**

**(Elevated Intelligence?)**

**High Values**

# Favorable Characteristics

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- **Comparison between Operators and Managers:**

## **Operators**

**High Confidence**  
**Healthy Self-Doubt**

**(Hand-Eye Coordin.?)**

**Mental Discipline**

**Operate under stress**  
**[threat of death]**

## **Managers**

**High Confidence**  
**Healthy Self-Doubt**

**(Elevated Intelligence?)**

**High Values**

**Make effective decisions**  
**[threat of anguish]**

# Examples

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- **“Risky Program” Excuse**
  - “We can make the Shuttle as safe as possible, and then we’ll never fly.”
    - Sends two messages:
      - 1. Generic: **We’re willing to accept additional risk**
      - 2. Specific: **We don’t want to address your issue**
- **Accusations of “Risk Aversion”**
  - Provokes **Dangerous Decisions**

# Examples

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- **“Risk Aversion” Response:**
  - **How much risk** we are willing to accept?
    - Challenge ourselves to accept more risk
- **More relevant Question:**
  - How do we distinguish between unnecessary risk and necessary risk?
    - How do we **eliminate** the former and **mitigate** the latter?

# Mitigating Risk

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- **High Reliability Organizations**
  - Address **Every** Issue
    - Listen, evaluate
    - Make Decision Objectively
      - **Accept necessary risk**,
      - **Don't accept unnecessary risk**
      - Provide rationale, re-evaluate
        - » Might convince the more conservative people that **additional risk is acceptable**
        - » Encourage continued **conservatism**
      - Elevate, commensurate with magnitude of issue, especially if there is **disagreement**



# Summary

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- **Ineffective Risk Decisions**
  - Risk/Benefit Bias
  - Misunderstood or Ignored Risks
  - **Fail to Postulate Accident**
    - Loss of Life
    - Loss of Assets
    - Psychological Consequences

# Summary

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- **Effective Risk Deliberations**
  - **Consider the Risk**
    - Understand Probabilities
    - Deliberate Candidly, Objectively
  - **Manage the Risk**
    - Eliminate the Unnecessary Risk
    - Mitigate the Necessary Risk

# Summary

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- **Effective Risk Deliberations (cont'd)**
  - **Acknowledge the Consequences**
    - Be Willing to Forgo the Benefits
    - Be Willing to Accept the Losses
  - **Integrate Accumulated Risk**
    - Collective Wisdom is Needed
    - Communication is Crucial